Appendix C

Standards and Permits

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Operations at the Hanford Site must conform to a variety of governmental standards and permits designed to ensure the biological and physical quality of the environment for public health, ecological, or aesthetic considerations. The primary environmental quality standards and permits applicable to Hanford operations in 1995 are listed in the following tables. The State of Washington has promulgated water quality standards for the Columbia River, Washington Administrative Code 173-201A. The Hanford Reach of the Columbia River has been designated as Class A (Excellent). This designation requires that the water be usable for substantially all needs, including drinking water, recreation, and wildlife. Class A water standards are summarized in Table C.1. Drinking water standards promulgated by the U.S. Environmental Protection Agency (EPA) in 40 Code of Federal Regulations (CFR) 141 are summarized in Table C.2. Select surface freshwater quality criteria for toxic pollutants are included in Table C.3.

Environmental radiation protection standards are published in U.S. Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment." This DOE order establishes new limits for public radiation dose and gives guidance for keeping radiation exposures to members of the public as low as reasonably achievable. These standards are based on guidelines recommended by authoritative organizations, such as the International Commission on Radiological Protection and the National Council on Radiation Protection and Measurements. The DOE has initiated a policy for creating and implementing public radiation protection standards that are generally consistent with the standards used by the U.S. Nuclear Regulatory Commission in regulating and licensing non-DOE nuclear facilities (i.e., nuclear power plants). Table C.4 shows the radiation standards from DOE Order 5400.5. These standards govern allowable public exposures to ionizing radiation from DOE operations.

In Order 5400.5, the DOE established Derived Concentration Guides that reflect the concentrations of individual nuclides in water or air that would result in an effective dose equivalent of 100 mrem per year caused by ingestion of water or inhalation of air at average annual intake rates. Derived Concentration Guides are not exposure limits, but are simply reference values that are provided to allow for comparisons of radionuclide concentrations in environmental media. Table C.5 lists selected DOE Derived Concentration Guides for radionuclides of particular interest at the Hanford Site. The Derived Concentration Guides are useful reference values but do not generally represent concentrations in the environment that ensure compliance with either the DOE, the Clean Air Act, or drinking water dose standards.

Permits required for regulated releases to water and air have been issued by the EPA under the National Pollutant Discharge Elimination System of the Clean Water Act and the Prevention of Significant Deterioration requirements of the Clean Air Act. Also, under authority granted by the Clean Air Act, the Washington State Department of Health has issued a permit for Hanford radioactive air emissions. Permits for collecting wildlife for environmental sampling are issued by the Washington State Department of Fish and Wildlife and the U.S. Fish and Wildlife Service. Current permits are discussed in Table C.6.

Table C.1. Washington State Water Quality Standards for the Hanford Reach of the Columbia River

Parameter	Permissible Levels
Fecal coliform	1) geometric mean value ≤100 colonies/100 mL 2) ≤10% of samples may exceed 200 colonies/100 mL
Dissolved oxygen	>8 mg/L
Temperature	1) ≤20°C (68°F) due to human activities 2) When natural conditions exceed 20°C, no temperature increases will be allowed that will raise the temperature of the receiving water by more than 0.3°C. 3) Incremental temperature increases resulting from point sources shall not, at any time, exceed 34/(T + 9), where T = background temperature. Incremental temperature increases resulting from non-point sources shall not exceed 2.8°C.
pH	1) 6.5 to 8.5 range 2) <0.5 unit induced variation
Turbidity	≤5 NTU[(a)] over background turbidity
Toxic, radioactive, or deleterious materials	Concentrations shall be below those of public health significance, or which cause acute or chronic toxic conditions to the most sensitive aquatic biota, or which may adversely affect characteristic water uses.
Aesthetic value	Shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.
Radioactive substances	Deleterious concentrations of radioactive materials for all classes shall be as determined by the lowest practicable concentration attainable and in no case shall exceed U.S. EPA Drinking Water Regulations for radionuclides, as published in the *Federal Register* for July 9, 1976, or subsequent revisions thereto (see Table C.2).
Toxic substances	Toxic substances shall not be introduced above natural background levels in waters of the state which have the potential either singularly or cumulatively to adversely affect characteristic water uses, cause acute or chronic toxicity to the most sensitive biota dependent upon those waters, or adversely affect public health, as determined by the department (see Table C.3).

(a) NTU = nephelometric turbidity units.

Table C.2. Selected Radiological Drinking Water Standards

Radiological Constituent	Critical Organ	Maximum Contaminant Level (pCi/L)	Agency	EPA Status	Reference
Total alpha (excluding uranium)		15	DOH,[a] EPA[b]	Final	WAC 246-290, 40 CFR 141.15
Radium-226		3	DOH		WAC 246-290
Beta and gamma radioactivity		4 mrem/yr[c]	DOE, EPA	Final	WAC 246-290, 40 CFR 141.16
Tritium	Whole body	20,000[d]	EPA		
Beryllium-7	GI (LLI)[e]	6,000[d]	EPA		
Cobalt-60	GI (LLI)	100[d]	EPA		
Strontium-90	Bone marrow	8[d]	EPA		
Technetium-99	GI (LLI)	900[d]	EPA		
Ruthenium-106	GI (LLI)	30[d]	EPA		
Antimony-125	GI (LLI)	300[d]	EPA		
Iodine-129	Thyroid	1[d]	EPA		
Iodine-131	Thyroid	3[d]	EPA		
Cesium-134	GI (S)[f]	20,000[d]	EPA		
Cesium-137	Whole Body	200[d]	EPA		
Europium-154	GI (LLI)	200[d]	EPA		
Europium-155	GI (LLI)	600[d]	EPA		
Uranium		20[g,h]	EPA	Proposed	

(a) Washington State Department of Health.
(b) U.S. Environmental Protection Agency.
(c) Beta and gamma radioactivity from manmade radionuclides. Annual average concentration shall not produce an annual dose equivalent from manmade radionuclides to the total body or any internal organ dose greater than 4 mrem/yr. Compliance may be assumed if annual average concentrations of total beta, tritium, and strontium-90 are less than 50, 20,000, and 8 pCi/L, respectively.
(d) Concentration assumed to yield an annual dose of 4 mrem/yr.
(e) GI (LLI) = gastrointestinal tract (lower large intestine).
(f) (S) = stomach.
(g) µg/L.
(h) Equivalent to a nationwide EPA standard of 30 pCi/L and a sitewide standard of 13.4 pCi/L (see Section 4.8, "Ground-Water Protection and Monitoring Program").

Table C.3. Select Surface Freshwater Quality Criteria for Toxic Pollutants

Compound	Level that Yields Acute Toxicity[a]	Level that Yields Chronic Toxicity[a]	Level to Protect Human Health for the Consumption of Water and Organisms[b]
	µg/L		
Total Recoverable Metals			
Antimony	--	--	14
Arsenic	360.0	190.0	0.018
Cadmium	[c]	[d]	--
Chromium[e] (III)	[f]	[g]	--
(VI)	16.0	11.0	--
Copper	[h]	[i]	
Lead	[j]	[k]	--
Mercury	2.4	0.012	0.14
Nickel	[l]	[m]	610
Selenium	20.0	5.0	--
Silver	[n]	--	--
Thallium	--	--	1.7
Zinc	[o]	[p]	--
Anions			
Cyanide[q]	22.0	5.2	700
Chloride[r]	860,000	230,000	--
Organic Compounds			
Benzene	--	--	1.2
Carbon tetrachloride	--	--	0.25
Chloroform	--	--	5.7
1,2-Dichloroethane	--	--	0.38
Methylene chloride	--	--	4.7
Toluene	--	--	6800
Tetrachloroethylene	--	--	0.8
1,1,2-trichloroethane	--	--	0.60
Trichloroethylene	--	--	2.7
Vinyl chloride	--	--	2
1,4-dichlorobenzene	--	--	400

(a) Washington Administrative Code 173-201A-040.
(b) 40 Code of Federal Regulations 131.36.
(c) exp(1.128[ln(hardness)]-3.828). Hardness expressed as mg $CaCO_3$/L.
(d) exp(0.7852[ln(hardness)]-3.490).
(e) Where methods to measure trivalent chromium are unavailable, these criteria are to be represented by total recoverable chromium.
(f) exp(0.8190[ln(hardness)]+3.688).
(g) exp(0.8190[ln(hardness)]+1.561).
(h) exp(0.9422[ln(hardness)]-1.464).
(i) exp(0.8545[ln(hardness)]-1.465).
(j) exp(1.273[ln(hardness)]-1.460).
(k) exp(1.273[ln(hardness)]-4.705).
(l) exp(0.8460[ln(hardness)]+3.3612).
(m) exp(0.8460[ln(hardness)]+1.1645).
(n) exp(1.72[ln(hardness)]-6.52).
(o) exp(0.8473[ln(hardness)]+0.8604).
(p) exp(0.8473[ln(hardness)]+0.7614).
(q) Criteria based on weak and dissociable method.
(r) Dissolved in association with sodium.

Table C.4. Radiation Standards (Dose Limits[a]) for Protection of the Public from All Routine DOE Activities

All Pathways [limits from DOE Order 5400.5]

The effective dose equivalent for any member of the public from all routine DOE activities[b] shall not exceed the values given below.

	Effective Dose Equivalent[c]	
	mrem/yr	mSv/yr
Routine Public Dose	100	1
Potential Authorized Temporary Public Dose[d]	500	5

Dose to Native Aquatic Animal Organisms from Liquid Discharges [interim limits from DOE Order 5400.5]

Radioactive material in liquid wastes discharged to natural waterways shall not cause an absorbed dose[e] to native aquatic animal organisms that exceeds 1 rad per day (10 mGy per day).

Drinking Water Pathway Only [limits from 40 CFR 141 and DOE Order 5400.5]

Radionuclide concentrations in DOE-operated public drinking water supplies shall not cause persons consuming the water to receive an effective dose equivalent greater than 4 mrem (0.04 mSv) in a year. DOE activities shall not cause private or public drinking water systems downstream of the facility discharge to exceed the radiological drinking water limits in 40 CFR 141 (Table C.2).

Air Pathways Only [limits from 40 CFR 61]

	Effective Dose Equivalent[c]	
	mrem/yr	mSv/yr
Public Dose Limit at Location of Maximum Annual Air Concentration as a Consequence of Routine DOE Activities[b]	10	0.1

(a) Radiation doses received from natural background, residual weapons testing and nuclear accident fallout, medical exposures, and consumer products are excluded from the implementation of these dose limits.
(b) "Routine DOE activities" implies normal, planned activities and does not include actual or potential accidental or unplanned releases.
(c) Effective dose equivalent is expressed in rem (or millirem) with the corresponding value in sievert (or millisievert) in parentheses.
(d) Authorized temporary annual dose limits may be greater than 100 mrem/yr (but cannot exceed 500 mrem/yr) if unusual circumstances exist that make avoidance of doses greater than 100 mrem to the public impracticable. The Richland Operations Office is required to request and receive specific authorization from DOE Headquarters for an increase from the routine public dose limit to a temporary annual dose limit.
(e) Absorbed dose is expressed in rad (or millirad) with the corresponding value in gray (or milligray) in parentheses.

Table C.5. Selected Derived Concentration Guides[a,b,c]

Radionuclide	Water, pCi/L (10^{-9} µCi/mL)	Air, pCi/m^3 (10^{-12} µCi/mL)
^{3}H	2,000,000	100,000
^{14}C	70,000	500,000
^{51}Cr	1,000,000	60,000
^{54}Mn	50,000	2,000
^{60}Co	5,000	80
^{65}Zn	9,000	600
^{85}Kr	NS[d]	3,000,000
^{90}Sr	1,000	9
^{99}Tc	100,000	2,000
^{103}Ru	50,000	2,000
^{106}Ru	6,000	30
^{125}Sb	60,000	1,000
^{129}I	500	70
^{131}I	3,000	400
^{137}Cs	3,000	400
^{144}Ce	7,000	30
^{234}U	500	0.09
^{235}U	600	0.1
^{238}U	600	0.1
^{238}Pu	40	0.03
^{239}Pu	30	0.02
^{240}Pu	30	0.02
^{241}Am	NS	0.02

(a) Concentration of a specific radionuclide in water or air that could be continuously consumed or inhaled at average annual rates and not exceed an effective dose equivalent of 100 mrem/yr.

(b) Values in this table represent the lowest, most conservative derived concentration guides considered potentially applicable to Hanford operations, and may be adjusted upward (larger) if accurate solubility information is available.

(c) From DOE Order 5400.5.

(d) NS = no standard.

Table C.6. Environmental Permits

Clean Water Act Permit

See information on Clean Water Act in Section 2.2, "Compliance Status."

Clean Air Act Permits

Prevention of Significant Deterioration Permit No. PSD-X80-14, issued to the Richland Operations Office by Region 10 of the EPA, covers emission of NO_x to the atmosphere from the Plutonium-Uranium Extraction Plant and the Uranium-TriOxide Plant. No expiration date.

Radioactive Air Emission Permit No. FF-01, issued to the Richland Operations Office by the Washington State Department of Health under authority granted by the Clean Air Act, covers operations on the Hanford Site having a potential to emit radioactive airborne effluents. Initially issued August 15, 1991, the permit was updated August 1993.

Wildlife Sampling Permits

Scientific Collection Permit WM-0039, issued by Washington State Department of Fish and Wildlife to Pacific Northwest National Laboratory for 1995, covered the collection of food fish, shellfish, and wildlife, including gamefish, for environmental monitoring purposes. Renewed annually.

Federal Fish and Wildlife Permit No. 671877, issued by the U.S. Fish and Wildlife Service to Pacific Northwest National Laboratory, covers the collection of migratory wildlife. Renewed every other year.

Copies of the regulations concerning these permits may be obtained from the following organizations:

State of Washington
Department of Ecology
300 Desmond Drive
Lacey, WA 98503

U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, WA 98101

U.S. Department of Energy
Richland Operations Office
825 Jadwin Ave.
Richland, WA 99352

References

40 CFR 61. U.S. Environmental Protection Agency, "National Emissions Standard for Hazardous Air Pollutants." *Code of Federal Regulations.*

40 CFR 131.36. U.S. Environmental Protection Agency, "Federally Promulgated Water Quality Standards." *Code of Federal Regulations.*

40 CFR 141. U.S. Environmental Protection Agency, "National Primary Drinking Water Regulations." *Code of Federal Regulations*.

Clean Air Act. Public Law 88-206, as amended, 42 USC 7401 et seq.

DOE Order 5400.5. 1990. "Radiation Protection of the Public and the Environment." Revised June 5, 1990 and January 7, 1993.

Washington Administrative Code (WAC) 173-201A. 1992. "Water Quality Standards for Surface Waters of the State of Washington," Washington State Department of Ecology.

Washington Administrative Code (WAC) 246-290. 1994. "Group A Public Water Systems," Washington State Department of Health.